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DE 004026589 A DE 003612464 A US 4817331 A
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(54) Method and apparatus for controlling worms

(57) Worms are removed from or killed in the ground by controlled electrification of a selected volume of ground to a level sufficient to destroy the worms therein or to encourage the worms to the surface of the ground for collection. The apparatus comprises two elongate conductors 12, 16 from each of which depend conductive probes 6, the conductors 12, 16 being located in spaced relationship on the ground with the probes 6 projecting into the ground. 240V is connected across the conductors 12, 16. The volume of ground bounded by the probes 6 is electrified to a selectively variable degree depending upon whether the worms are to be destroyed or collected. A pH/Moisture level meter is used to assess the conductivity of the ground and therefore the level of current required and the time needed.

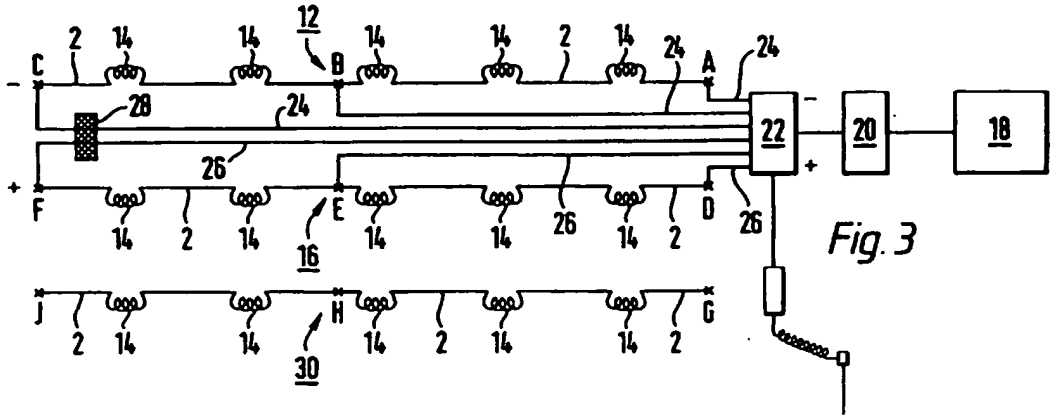

Fig. 3

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

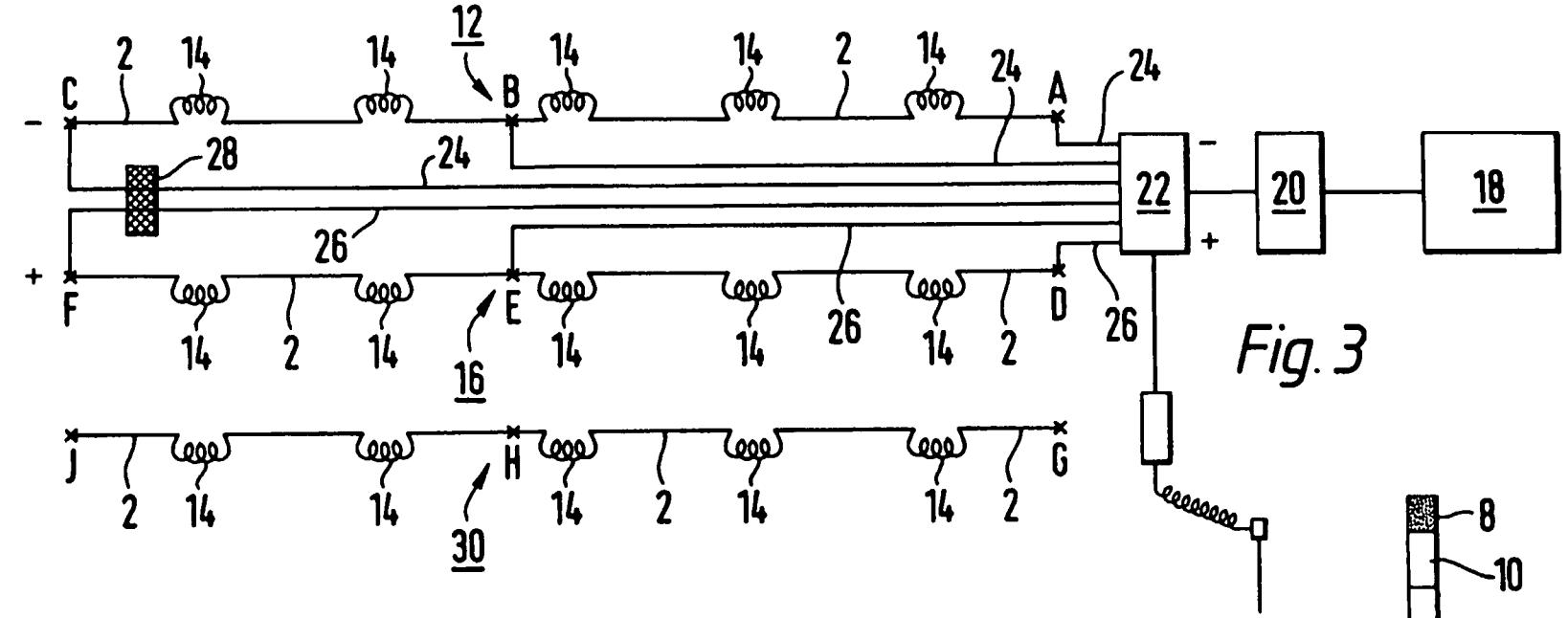

Fig. 3

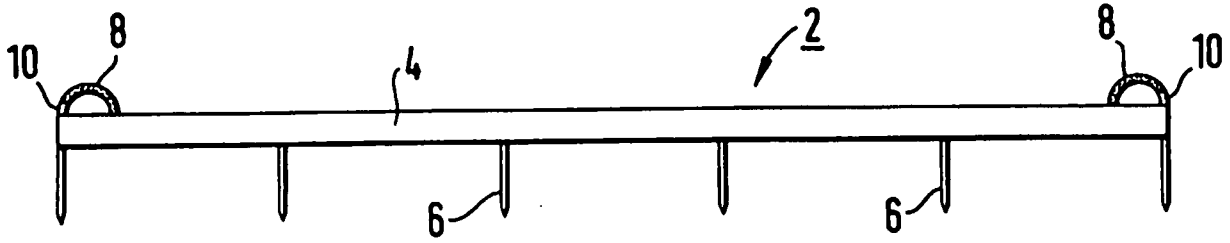

Fig. 1

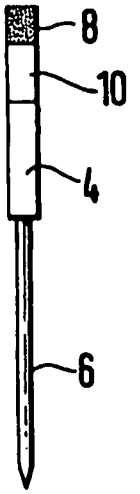

Fig. 2

METHOD AND APPARATUS FOR CONTROLLING WORMS

This invention relates to a method and apparatus for controlling worms, and has particular, though not exclusive, application to such method and apparatus for removing worms from the ground.

The destruction of worms in the ground, or the removal of worms from the ground may be required for any one of a number of reasons, and current practice is to achieve these aims using chemical means.

When removing worms from the ground for purposes of population analysis or study, the worms must not be harmed, and this is usually achieved either by digging out the worms manually or by soaking the ground with a liquid irritant such as soap to urge the worms to the surface of the ground to seek relief from the irritant. However, both these methods are time consuming and labour intensive.

In the case of grassed sportsgrounds, such as bowling greens or putting greens on golf courses, the casts produced by worms can have serious effects on the quality of the playing surfaces, while, in the case of lawns, worm casts can look unsightly. In these circumstances, it is desirable to kill the worms.

At present, the elimination of worm populations in sportsgrounds and the like is achieved using chemicals. However, such a method has a number of disadvantages - the chemicals are often expensive and difficult to use and apply; they only kill worms that are fairly close to the surface of the ground; they cannot kill worm eggs; they can leave toxic residues in the soil; they are non-selective in that they kill all worms of all sizes

and types.

In this latter respect, it is sometimes desirable to kill only some of the worm population. For example flatworms are predatory of earthworms, and, if it is desired to destroy the flatworms but not the earthworms, it is necessary to adopt the labourious and time consuming procedure outlined above for population analysis in which all the worms are removed, the flatworms are then destroyed, and the earthworms are returned to the ground.

It would be desirable to be able to provide a method and apparatus for controlling worms which were such as to enable selective elimination of the worms in the ground or removal of the worms from the ground in a more efficient and quicker manner than heretofore.

According to one aspect of the present invention, a method of controlling worms in the ground comprises the steps of providing a high voltage supply of electrical power, applying said supply to a volume of ground containing worms, and adjusting the level of said supply and the period of application of said supply either to kill the worms in the ground or to drive the worms to the surface of the ground for collection.

It will be appreciated that such a method enables the worms to be killed in situ or removed from the ground for analysis, selective segregation or the like, all in a particularly simple, economic manner and without any toxic residues remaining in the ground.

According to a further aspect of the present invention, there is provided apparatus for controlling worms, the apparatus

comprising at least two elongate electrical conductors from each of which depend a plurality of electrically conductive probes, and a high voltage supply of electrical power, one of said conductors being connected to the negative terminal of said supply and another of said conductors being connected to the positive terminal of said supply, the arrangement being such that, on location of said conductors in spaced relationship on the ground with the probes thereon projecting into the ground, and on completion of the power supply, electric current flows through the volume of ground bounded by the opposed conductors and the probes, the level of said current and the period of its application being selectively adjustable either to kill the worms in said volume of ground or to drive said worms to the surface of the ground for collection.

In a preferred embodiment of the invention, a plurality of elongate electrical conductor elements from each of which depend a plurality of probes are connected in series to form a first electrical conductor connected to the negative terminal of the power supply, and a further plurality of elongate electrical conductor elements from each of which depend a plurality of probes are connected in series to form a further electrical conductor connected to the positive terminal of the supply.

Conveniently the first and further electrical conductors are each connected to the associated terminal of the power supply at a plurality of spaced locations along the length of the conductor.

Preferably the apparatus comprises at least three elongate electrical conductors for spaced location on the ground, each

pair of adjacent conductors defining, together with their probes, an associated volume of ground for treatment, electrical power being supplied consecutively to adjacent pairs of conductors whereby adjacent volumes of ground are electrified consecutively.

The supply of electrical power may be, for example, 6 KVA generator providing 25 amps of current at 240 volts, the electrical circuit including an adjustable current control unit, conveniently a rheostat.

Preferably the electrical circuit includes a pH moisture level probe for determining the condition of the ground under treatment, and a current flow meter for monitoring the electrification of the ground during treatment.

By way of examples only, the aspects of the invention will now be described in greater detail with reference to the accompanying drawings of which:

Fig. 1 is a schematic front view of an electrical conductor element of apparatus according to the invention;

Fig. 2 is an end view, to a larger scale, of the electrical conductor element of Fig. 1, and

Fig. 3 is a schematic illustration of apparatus according to the invention in use.

Referring to Figs. 1 and 2, there is shown an electrical conductor element indicated generally at 2 and comprising an elongate bar 4 typically of mild steel which is coated with a plastics material for insulation purposes.

The bar 4 may be 3 metres long, 50 mm tall and 10 mm wide.

Six equispaced probes 6 project downwardly from the underside of the bar 4, said probes also being of mild steel,

preferably integrally formed with the bar 4. Each probe 6 may be 150 mm long with a pointed free end thereto.

Each end of the bar 4 is provided with an integral handle 8 of mild steel, each handle 8 being rubber coated for insulation purposes apart from a region 10 adjacent the bar 4 which is exposed to permit electrical connection thereto as will be detailed below.

Referring to Fig. 3, there is shown a working layout of the apparatus of the invention. More particularly a first elongate electrical conductor indicated generally at 12 consists of six elements 2 connected in series, adjacent elements 2 being interconnected by leads 14 clips of which engage the exposed regions 10 of the handles 8 of the associated elements.

A second elongate electrical conductor is indicated generally at 16 and is of similar construction to conductor 12. Adjacent elements 2 of the conductors 12,16 are spaced apart by about 600 mm, the total lengths of the conductors 12,16 being typically 21 metres.

The conductors 12,16 are located parallel with one another about 3 metres apart with their probes 6 pressed into the ground and with the bars 4 resting on the surface of the ground to define an initial volume of ground for treatment having dimensions 21 metres long, 3 metres wide and 150 mm deep.

A mobile 6 KVA generator is shown at 18 and is connected to the conductors 12,16 through a current control unit 20 in the form of an adjustable rheostat, and a power distribution unit 22.

More particularly three output leads 24 from the negative terminal of the unit 22 are connected to spaced apart points

A,B,C on the conductor 12, while three output leads 26 from the positive terminal of the unit 22 are connected to spaced apart points D,E,F on the conductor 16.

The amount of current required to flow through the volume of ground defined by the conductors 12,14 will be determined by a number of factors, in particular whether the worms therein are to be killed or collected, the moisture level of the ground, and the acid or alkaline content of the ground, which is indicative of the type of worm contained therein. The apparatus therefore includes a pH/moisture level detector or probe 28 for such purposes, while the rheostat 20 can be adjusted accordingly.

Once the required conditions and settings are determined, the electric power to the conductors 12,16 is switched on whereby the volume of ground therebetween is evenly electrified.

Worms are generally of the order of 70% water, and consequently, depending upon the level of current chosen, any worms within the electrified volume are either electrocuted within the volume or are urged to the surface of the ground to escape the discomfort applied thereto by the electrification.

Preferably a current flow metre 28 is installed in the volume of ground under treatment to monitor the conditions within the ground during treatment.

Thus, when it is desired to kill all earthworms present within the volume, as would be the case in bowling greens, putting greens on golf courses and the like, a relatively high current of up to of the order of 25 amps would be passed typically for up to 15 minutes.

Alternatively, in the case of population analysis or where

selective worms only are to be killed, a smaller current would be passed for a shorter time to encourage all the worms to the surface for collection and subsequent return to the ground, or for collection, segregation therefrom of the worms to be killed, such as flatworms, and subsequent return to the ground of the remainder.

When it is desired to destroy a breeding cycle by killing egg grubs and cocoons, the distance between the conductors 12,16 should be reduced, typically to 1.5 metres, and the current should be kept at full power for at least 6 minutes.

One or more further conductors such as that shown at 30 in Fig. 3 may be provided to extend the volume of ground available for treatment. The conductor 30 is of similar construction to the conductors 12,16, and is spaced typically by 3 metres from conductor 16. Once the volume of ground defined between the conductors 12,16 has been treated, the output leads 24 are removed from the conductor 12 and are attached to points G,H,J on conductor 30 whereby the volume of ground between the conductors 16,30 can be treated in the same manner as, and subsequent to, that between the conductors 12,16.

Thus the invention provides a method and apparatus whereby worms and other pests can either be destroyed in situ or extracted from the ground, the apparatus working extremely quickly, being cheaper and more effective than current arrangements, and being totally environmentally friendly.

Additionally, the invention is applicable to the destruction of egg grubs and cocoons to break breeding cycles, and enables population analysis to be carried out quickly and conveniently.

Clearly the precise nature of the apparatus can vary from that described and illustrated without departing from the scope of the invention - the configuration of the bars 4 and probes 6, as well as the number of elements 2 comprising a conductor 12,16,30, can be chosen to suit particular requirements, while the power supply 18 and the controls therefore will be determined by the nature of the ground, the type and numbers of worms under treatment, and the objective of the exercise, be it to destroy or collect the worms.

Although generally portable and mobile, the described apparatus may be permanently installed in, for example, bowling greens or like sporting locations.

CLAIMS

1. A method of controlling worms in the ground comprises the steps of providing a high voltage supply of electrical power, applying said supply to a volume of ground containing worms, and adjusting the level of said supply and the period of application of said supply either to kill the worms in the ground or to drive the worms to the surface of the ground for collection.

2. Apparatus for controlling worms, the apparatus comprising at least two elongate electrical conductors from each of which depend a plurality of electrically conductive probes, and a high voltage supply of electrical power, one of said conductors being connected to the negative terminal of said supply and another of said conductors being connected to the positive terminal of said supply, the arrangement being such that, on location of said conductors in spaced relationship on the ground with the probes thereon projecting into the ground, and on completion of the power supply, electric current flows through the volume of ground bounded by the opposed conductors and the probes, the level of said current and the period of its application being selectively adjustable either to kill the worms in said volume of ground or to drive said worms to the surface of the ground for collection.

3. Apparatus as claimed in claim 2 in which a plurality of elongate electrical conductor elements from each of which depend a plurality of probes are connected in series to form a first electrical conductor connected to the negative terminal of the power supply, and a further plurality of elongate electrical conductor elements from each of which depend a plurality of

probes are connected in series to form a further electrical conductor connected to the positive terminal of the supply.

4. Apparatus as claimed in claim 3 in which the first and further electrical conductors are each connected to the associated terminal of the power supply at a plurality of spaced locations along the length of the conductor.

5. Apparatus as claimed in any one of claims 2 to 4 and comprising at least three elongate electrical conductors for spaced location on the ground, each pair of adjacent conductors defining, together with their probes, an associated volume of ground for treatment, electrical power being supplied consecutively to adjacent pairs of conductors whereby adjacent volumes of ground are electrified consecutively.

6. Apparatus as claimed in any one of claims 2 to 5 in which the supply of electrical power is a generator providing 240 volts, the electrical circuit including an adjustable current control unit such as a rheostat.

7. Apparatus as claimed in any one of claims 2 to 6 in which the electrical circuit includes a pH moisture level probe for determining the condition of the ground under treatment, and a current flow meter for monitoring the electrification of the ground during treatment.

8. A method of controlling worms in the ground substantially as described with reference to the accompanying drawings.

9. Apparatus for controlling worms in the ground substantially as described with reference to and as illustrated by the accompanying drawings.

The Patent Office

Application No: GB 9608413.2
Claims searched: 1 to 9

Examiner: Ross Cavill
Date of search: 16 July 1996

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.O): A1M (MDD)

Int Cl (Ed.6): A01M (1/00,/22,17/00,19/00,29/00); H05C 1/00,/02,/04,/06,3/00

Other: Online:WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	US 4817331	(PODSIADLY) whole doc	1&2
X	US 4758318	(YOSHIDA) whole doc	1,2,6
X	US 3820279	(SIEPER) whole doc, note fig 1	1&2
X	DE 4026589	(THIELEMANN) whole doc	1&2
X	DE 3612464	(THIELEMANN) whole doc	1-5

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Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.